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# U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 724

## FEEDING GRAIN SORGHUMS TO LIVESTOCK

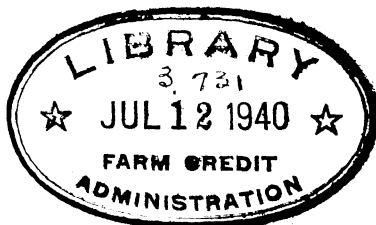


**G**RAIN SORGHUMS are the chief cultivated crops produced in the semiarid sections of the southwestern United States.

On account of the dryness of the climate, the lack of transportation facilities, and the distance from markets most of this region can be used only as range for cattle and sheep.

Most of the cattle and sheep in this area must be given some feed to carry them through the winter satisfactorily. Therefore, the importance of grain sorghums for this purpose is evident. In addition, there are times of drought when the range fails during the summer months.

As grain sorghums make good silage, they may be ensiled and held in reserve without appreciable deterioration for several years. Stockmen can thereby insure themselves against heavy losses such as frequently occur in times of protracted drought.



# FEEDING GRAIN SORGHUMS TO LIVESTOCK.

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THE profitable disposal of the large crops of nonsaccharine, or grain sorghums produced in the semiarid sections of the United States depends almost entirely upon feeding them to livestock on the farms where they are produced. Only a small proportion of producers of these crops are near enough to city markets to sell the grain at a direct profit. But marketing the crops in the form of beef, pork, mutton, milk, or poultry greatly increases the opportunity of the average grower for a favorable financial outcome. Feeding the crops also utilizes both the grain and the roughage and makes manure available for maintaining soil fertility.

The grain sorghums which have been grown most widely in this country are kafir, milo, feterita, kaoliang, shallu, and durra. These crops are to the Great Plains region what corn is to the Corn Belt. The whole plant may be fed, either green, cured, ensiled, or headed when ripe, so that the heads can be threshed and the grain fed separately. The grain sorghums have less feeding value than corn, but the fact that they are heavy yielders in semiarid sections where corn fails more than compensates for the small difference in feeding value.

Closely related to the grain sorghums are the sorgos.<sup>2</sup> They produce a palatable hay or fodder much relished by stock and possessing about the same value as prairie hay. The seeds of sorgo are much less palatable and nutritious than those of the grain sorghums.

Some prejudice has existed as to the value of sorgo for silage, chiefly in the belief that it is highly acid. However, experiments and the experience of practical farmers show that sorgo silage is a good cattle feed, especially when a little dry roughage and a high-protein meal are fed with it.

In the South both classes of sorghums are pastured, particularly sorgo. The chief danger in the practice lies in the fact that poisoning may occur if stunted or second-growth plants are eaten. This point is more specifically referred to later.

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<sup>1</sup> Mr. Scott resigned January 7, 1920. Bulletin revised by Arthur T. Semple, Animal Husbandry Division.

<sup>2</sup> The term "sorgo" has been adopted by the department as a preferred name for the sweet-juiced sorghum varieties which are also known as cane sorghum, saccharine sorghum, and sweet sorghum.



FIG. 1.—A plat of Dwarf Blackhull kafir. This variety matures earlier than standard Blackhull kafir.

### GRAIN SORGHUMS SIMILAR TO CORN IN FEEDING VALUE.

Chemical analyses of grain sorghums indicate that they are very similar to corn in composition. Corn, however, contains more fat, while sorghums contain more protein. The amounts of carbohydrates in the two are practically equal. Table 1 shows the chemical analyses of several varieties of grain sorghums grown at Amarillo, Tex. The average of many analyses of corn is given for comparison.

TABLE 1.—Chemical analyses<sup>1</sup> of air-dry samples of various grain-sorghum varieties grown at the Amarillo Cereal Field Station, Amarillo, Tex., 1908 to 1912, inclusive, compared with analyses of dent corn.

Feed.	Number of analyses.	Water.	Ash.	Nitrogen.	Protein.	Carbohydrates.	Fat.	Fiber.	Weight per—	
									1,000 kernels.	Bushel.
Milo.....	67	9.32	1.62	2.01	12.54	71.89	3.15	1.48	Grams.	Pounds.
Dwarf milo.....	55	9.38	1.63	1.92	12.16	72.09	3.27	1.47	36.1	58.1
Average of 2 milos...	122	9.35	1.62	1.97	12.37	71.97	3.21	1.48	31.4	58.2
Feterita.....	8	9.58	1.72	2.24	14.00	70.32	2.90	1.48	34.0	58.1
Blackhull kafir.....	78	9.58	1.78	2.25	14.10	69.49	3.47	1.58	32.2	55.9
Dwarf Blackhull kafir.....	13	9.95	1.70	2.09	13.09	70.49	3.25	1.52	21.6	58.0
Average of 7 kafirs...	91	9.63	1.77	2.23	13.95	66.65	3.43	1.57	16.6	58.7
Red kafir.....	37	9.56	1.73	1.92	12.01	72.03	3.16	1.51	20.9	58.1
Average of 3 kafirs...	128	9.61	1.76	2.14	13.39	70.33	3.35	1.55	18.5	58.3
Shallu <sup>2</sup> .....	10	10.38	1.98	2.42	15.17	66.86	3.69	1.92	20.1	58.2
Average of all varieties....	268	9.52	1.70	2.07	13.01	70.95	3.29	1.53	15.1	57.9
Dent corn <sup>3</sup> .....	1,294	12.9	1.3	.....	9.3	70.3	4.3	1.9	26.6	58.1

<sup>1</sup> Analyses by the Plant Chemical Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture.

<sup>2</sup> Grown only in the years 1911 and 1912.

<sup>3</sup> Compiled by Bureau of Chemistry, U. S. Department of Agriculture.

The amount of digestible nutrients which grain sorghums contain concerns the feeder more than does the composition, as they are the compounds which are assimilated and used to produce heat, energy, fat, milk, muscle, and bone. Table 2 compares the digestible nutrients in 100 pounds of kafir grain and shelled dent corn. The carbohydrate equivalent is the sum of the digestible carbohydrates plus  $2\frac{1}{4}$  times the digestible fat. Kafir may be taken as representative of the groups of grain sorghums grown in the United States.

TABLE 2.—*Digestible nutrients in 100 pounds of feed.*

Feed.	Dry matter in 100 pounds.	Digestible nutrients in 100 pounds.		Nutritive ratio.
		Crude protein.	Carbohydrate equivalent.	
	Pounds.	Pounds.	Pounds.	
Kafir grain.....	90.4	7.5	56.3	1 : 7.5
Dent corn.....	87.1	7.1	74.8	1 : 10.5

### USE OF SORGHUMS FOR VARIOUS KINDS OF LIVESTOCK.

Cattle, sheep, horses, mules, hogs, and poultry relish and do very well on grain sorghums. However, as the grains are so small and hard that many of them pass through the digestive tract unbroken, it pays to grind them for all stock except sheep and poultry, provided



FIG. 2.—Fattening pigs on milo maize, using self-feeder.

generally that the cost of grinding is not more than 10 per cent of the value of the grain. Sheep chew the whole grains well. For poultry they are better whole than ground. Some commercial poultry feeds contain a considerable proportion of sorghum grains. For other stock grinding increases the palatability. Very often the entire heads are

ground. The resulting meal, called head chop, is similar to corn-and-cob meal in food value and is recommended especially when the supply of roughage is limited.

The quantities to be fed to the different kinds of animals depend upon many factors, such as the quantity and kind of roughage and of other concentrates available, age, type, and size of the animals, and for what purpose the stock is being fed.

### **PROTEIN FEEDS NECESSARY WITH GRAIN SORGHUMS.**

The feeder should always remember that grain sorghums do not form a balanced ration for growing animals. The proper growth of young animals and the economical production of milk are impossible when there is not sufficient protein and mineral matter or ash in the ration. Some feed that is rich in protein and ash must be given for favorable results. Legume hay, milk, the cakes and meals produced in extracting oil from seeds, and packing-house and fishery by-products are rich in protein and ash. When sufficient alfalfa, clover, or other legume hay is used, protein-rich concentrates are not necessary. Otherwise the ration should be balanced by adding some feed such as cottonseed meal or cake, linseed meal, or peanut meal. Skim milk, soy beans, or tankage can be used to balance hog rations.

### **SORGHUM STOVER A PALATABLE ROUGHAGE.**

The grain sorghums may be utilized as forage in the form of stover and fodder or they may be put into silos. For these purposes they compare favorably with corn. Well-cured stover and fodder are well liked by cattle, horses, and sheep, and in some sections are



FIG. 3.—Purebred cows in the Texas Panhandle wintered on kafir stover and a little grain.

practically the sole roughage fed during the winter. Cattle can be wintered well on grain-sorghum stover (fodder from which heads have been removed), with a small allowance of some feed rich in protein. For young stock more of the protein feed and some grain in addition should be fed.

**SORGHUM SILAGE HAS SOME PROPERTIES OF GREEN FEED.**

As with corn, silage is often the most economical form in which the grain-sorghum crops may be utilized, especially for sheep and cattle. When cut at the proper stage, when the seeds are in the stiff-dough stage, grain sorghum has a feeding value practically equal to that of corn silage. Silage is particularly useful in the ration of cattle to aid in keeping the body in proper tone and to increase the animal's appetite. The amount which can be fed varies from a few pounds for a calf up to 40 or 50 pounds, or even more, for a dairy cow or a heavy steer.

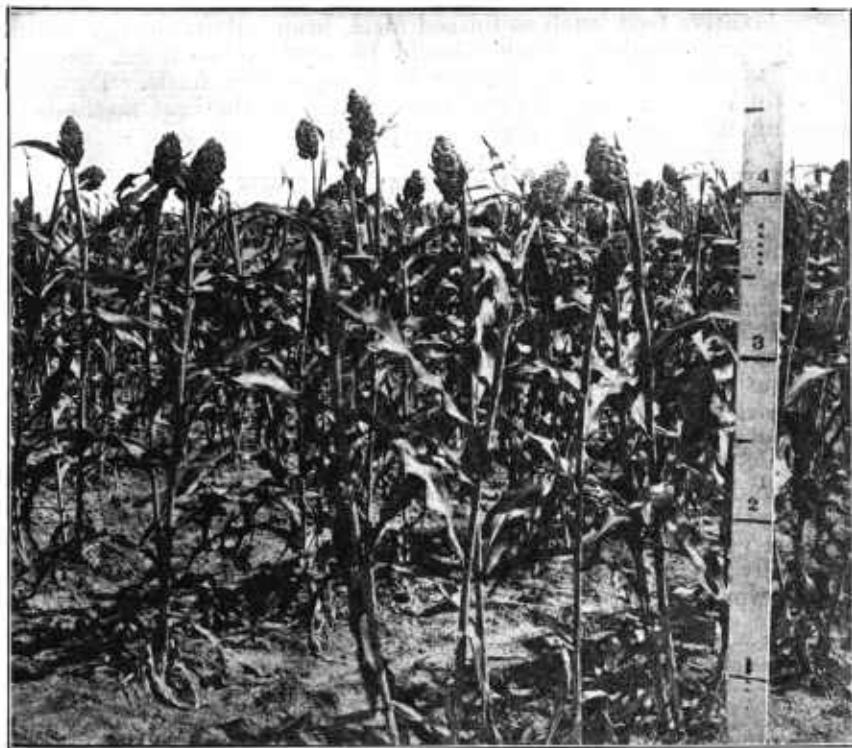


FIG. 4.—A plat of milo, selected for erect heads and low stature.

Silage should be fed with a liberal addition of concentrates to growing and fattening cattle and sheep and to cows producing a heavy flow of milk. It contains so much water and crude fiber (though not so much of the latter as field-cured stover) that stock can eat and digest scarcely enough of it to supply their requirements for maintenance. Its use to supply the bulk of nutrients in a ration is chiefly in wintering beef breeding cows and stockers. In most cases some feed rich in protein should be fed with it, especially in feeding breeding cows. Farmers' Bulletin 578 gives detailed information concerning the making and feeding of silage.



### USE CARE IN PASTURING ALL SORGHUMS.

Sometimes stock are killed by grazing on stunted or second-growth sorgo and grain sorghum. Stunting may be caused by extreme drought or other adverse conditions. At such stages of growth prussic acid, a deadly poison, sometimes accumulates in the plant tissue. When eaten by livestock in sufficient amounts it causes poisoning, which is usually fatal. As the plants have this poisonous property only under the conditions mentioned, losses may be avoided by using care and not turning the stock on such forage when they are unusually hungry. No losses have been reported from poisoning in feeding the grain, heads, silage, hay fodder, or stover of the grain sorghums.

Some feeders have found that the sorghum grains, if fed heavily, constipate stock. To counteract this, it is better to feed with them some laxative feed, such as linseed meal, bran, alfalfa, or soy beans. Moldy grain-sorghum feeds should be avoided as much as possible, as there is usually danger in using moldy feeds. Farmers' Bulletin 1158 furnishes information relative to the best methods of growing and harvesting sorghum crops.

### VALUE OF GRAIN SORGHUMS SHOWN BY FEEDING TESTS.

A number of practical cattle-feeding tests have been carried on in the Texas Panhandle region, under supervision of a field agent of the Bureau of Animal Industry. In these tests the grain sorghums were fed to beef cattle in a variety of forms and combinations and in most cases formed the bulk of the rations fed. The data gathered from this work indicate clearly the efficiency of the grain-sorghum feeds in the form of chop, head chop, silage, fodder, and stover, both in wintering cattle and in finishing them for the block. Silage of the grain sorghums, when fed as shown in Table 3, was found to be very beneficial for increasing the appetites of feeders, keeping them in fine condition, and adding a high finish. Cottonseed meal is very efficient as a supplement to kafir and milo feeds, and especially in conjunction with silage. Table 3 summarizes the results of this work.

TABLE 3.—*Results of use of grain sorghums in feeding tests carried out on Texas farms in cooperation with the United States Department of Agriculture, 1914-15.*

Age of cattle.	Number fed.	Date of feeding.	Length of feeding period.	Average daily ration per head.	Total average gain per head.	Average daily gain per head.
			<i>Days.</i>		<i>Pounds.</i>	<i>Pounds.</i>
(1) 2 years.....	127	Oct. 28 to Feb. 2..	97	Cottonseed meal, 4.4 pounds; kafir chops, 2.8 pounds; silage, 26.1 pounds; sorghum hay, 13.2 pounds.	195	2.01
(2) 3 years.....	68	Jan. 17 to July 3 ..	167	Cottonseed meal, 4.6 pounds; silage, 61.6 pounds; bundled kafir, 6 pounds.	292	1.75
(3) Heifer calves ..	116	Oct. 31 to May 1..	182	Cottonseed meal, 1.6 pounds; milo chops, 3.3 pounds; silage, 25 pounds; wheat straw. <sup>1</sup>	249	1.37
(4) Heifer calves....	126	.....do.....	182	Cottonseed meal, 1.1 pounds; milo chops, 3.8 pounds; silage, 25 pounds; straw. <sup>1</sup>	248	1.36
(5) Calves.....	230	Winter.....	165	Cottonseed meal, 1.5 pounds; silage, 25 pounds; straw. <sup>1</sup>	230	139

<sup>1</sup> Were given all they would eat.

On the whole, the results in Table 3 indicate that the grain sorghums are efficient beef producers. The use of cottonseed meal and silage in all the rations is noticeable. These two feeds form an extremely palatable and efficient combination, and are conveniently fed together. The meal is usually mixed with the silage as it is fed. Dry roughages, such as straw, stover, and fodder, are readily eaten in connection with silage and cottonseed meal; thus the maximum amount of roughage may be utilized to advantage. Nos. 2 and 5 in Table 3 illustrate these points well.

When cottonseed meal is high in price it may be more economical to feed smaller quantities than are indicated in these rations, substituting, if possible, legume hay. The rations for beef cattle on page 10 are suggested with the high price of cottonseed meal in view. The amounts of grain sorghum in a ration should be increased when the



FIG 5.—Yearling steers fattened on ground milo in northeastern New Mexico.

allowance of cottonseed meal is cut down. One pound of cottonseed meal is usually considered equal in nutritive value to 2 pounds of sorghum-grain chop.

The State experiment stations at Manhattan, Kans., Stillwater, Okla., and College Station, Tex., have carried on feeding experiments with various classes of livestock in which the grain sorghums formed a large part of the rations fed.

The Kansas station reports the economical use of kafir silage, wheat straw, and a small amount of cottonseed meal for wintering beef steers. Ground kafir and alfalfa hay were used very successfully for fattening steers. When no protein-rich concentrates or roughages were fed with ground kafir unsatisfactory gains followed. The Texas station has found that a mixture of about 4 parts of ground kafir or milo and 1 part cottonseed meal fed with cottonseed hulls and sorghum hay or kafir stover produced excellent gains. A larger

amount of sorghum grain was fed than is customary in the case of corn. For example, a lot of 3-year-old steers were given a ration composed of 21 pounds ground kafir, 4 pounds cottonseed meal, and all the kafir stover they would eat. These steers made an average daily gain of 3.1 pounds a head during a period of 85 days.

The Kansas and Oklahoma stations fed ground kafir with a large amount of alfalfa hay to dairy cows with good results. When the alfalfa hay was substituted by timothy, prairie hay, kafir fodder, or sorghum hay, milk production was seriously cut down, owing to the lack of protein in such combinations. Silage from grain sorghums in the rations of dairy cows proved practically as valuable as corn silage.

At the Kansas station pigs were fed ground kafir and milo, supplemented by tankage and shorts, soy-bean meal, and alfalfa, with excel-



FIG. 6.—Steer calves fattened on ground milo heads in western Texas.

lent results. In these experiments the largest and cheapest gains were produced by the ration in which shorts and tankage formed the supplements. Where sorghum grains have been properly supplemented by protein-rich feeds, they have produced only 2 to 10 per cent less gains than the same amount of corn would produce.

Lambs were fed at the Kansas station, both whole and ground kafir being used with cottonseed meal. The gains secured indicate that the feeding value of these grains is slightly less than that of corn. Grinding the kafir for sheep and lambs did not pay.

Horses and mules have been fed the sorghum grains at the Oklahoma station, and the results indicate that for such stock these feeds are palatable and nutritious, and are also economical in regions where they grow better than corn. The experience of farmers who have long used these feeds for their horses and mules is in accord with these reports.

**SAMPLE RATIONS FOR VARIOUS KINDS OF STOCK.**

While no standard combination of feeds can be given that will apply to all sections where grain sorghums are grown extensively, the following rations are suggested for various classes of livestock. They are intended chiefly to show the proportions of grain, protein-rich concentrate, silage, stover, straw, and hay to use.

For a 100-pound animal use one-tenth of the sample ration, for a 500-pound animal one-half, for a 1,200-pound animal 1.2 times the ration, and for other weights similar fractions or multiples of the sample ration. In the fattening rations the proportion of roughage to concentrates should be much greater at the beginning of the feeding period than shown in the table. Always put animals on full feed gradually. Toward the close of the fattening process the amounts of grain should be increased gradually and the proportion of roughage lowered accordingly. Many kinds of grain, hay, and stover may be used in place of kafir or milo grain and stover. Alfalfa may be replaced by other legume hays. If no such hay is available, it is advisable to use a protein-rich concentrate. Cottonseed meal may be replaced by linseed meal, soy-bean meal, or peanut meal.

TABLE 4.—Daily rations per 1,000 pounds live weight.

WINTERING BEEF CATTLE.					
Calves.		Yearlings.		Two-year-olds and aged cattle.	
<i>Pounds.</i>		<i>Pounds.</i>		<i>Pounds.</i>	
Kafir silage.....	36	Kafir silage.....	48	Kafir fodder.....	24
Alfalfa hay.....	15	Alfalfa hay.....	9	Cottonseed cake.....	2
Kafir grain.....	4	or		or	
Cottonseed cake.....	2	Kafir fodder.....	40	Kafir silage.....	20
		Cottonseed cake.....	3	Wheat straw.....	16
				Cottonseed cake.....	1
FATTENING BEEF CATTLE.					
Calves.		Two-year-olds and aged steers.			
<i>200 days' feed.</i>		<i>170 days' feed.</i>		<i>130 days' feed.</i>	
<i>Pounds.</i>		<i>Pounds.</i>		<i>Pounds.</i>	
Kafir silage.....	25	Kafir silage.....	25	Kafir chop.....	17
Kafir chop.....	18	Kafir chop.....	14	Alfalfa hay.....	16
Kafir stover.....	4	Kafir stover.....	5		
Cottonseed meal... 3		Cottonseed meal... 5			
Peanut meal..... 3					
MAINTAINING DAIRY COWS.			COWS PRODUCING MILK.		
<i>No. 1. Pounds.</i>		<i>No. 2. Pounds.</i>			
Kafir silage.....	40	Kafir stover.....	28	For each pound of 4 per cent milk produced add 0.5 pound of kafir chop and 0.08 pound of cottonseed meal to the maintenance ration.	
Alfalfa hay.....	5	Alfalfa hay.....	8		
HORSES DOING MODERATE WORK.					
(Rations based on Armsby's energy values.)					
<i>No. 1. Pounds.</i>			<i>No. 2. Pounds.</i>		
Kafir chop.....		10	Kafir chop.....		9
Alfalfa hay.....		8	Alfalfa hay.....		2
Kafir stover.....		6	Cottonseed meal.....		1
			Kafir stover.....		10
FATTENING HOGS.			BROOD SOWS.		
<i>No. 1. Pounds.</i>		<i>No. 2. Pounds.</i>		<i>No. 1. Pounds.</i>	
Kafir chop.....	38	Kafir chop.....	38	Kafir chop.....	30
Soy beans.....	2	Tankage.....	1.5	Alfalfa hay.....	4
				Tankage.....	1
FATTENING SHEEP.			BREEDING SHEEP.		
<i>No. 1. Pounds.</i>		<i>No. 2. Pounds.</i>		<i>Pounds.</i>	
Kafir grain.....	20	Kafir grain.....	20	Kafir grain.....	10
Cottonseed meal... 2		Alfalfa hay.....	7	Kafir stover.....	10
Kafir stover.....	10	Kafir stover.....	3	Alfalfa hay.....	10